



Classroom Lesson Development

Title of Lesson **Transferring a Patterned Polymer to a Substrate**

RET Project Connection Transfer of Self-assembled Template-guided Polyaniline Solution onto a Flexible Substrate. Plastics Engineering Laboratory, UMass Lowell. Lowell, MA. Summer 2007

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School Dover High School

Town/District Dover, NH. SAU 11

Subject(s) taught Honors Chemistry, AP Chemistry

Subjects covered in lesson Polymers, Intermolecular Forces

Grades appropriate 11-12

Lesson duration <1 week (approximately four 50 minute periods)

Goals/Objectives of lesson Introducing students to polymer chemistry
Showing electrostatic adherence of a compound
Inquiry-based investigation

Background information The types and causes of intermolecular forces
Electricity and charges
Basic polymer structures, properties, and uses

Essential questions How can we manipulate polymers to create a desired outcome?

Links to Frameworks and Standards

National

State S:PS1:11:2.1 Explain that the physical properties of a compound are determined by its molecular structure and the interactions among the molecules.

S:PS1:11:2.2 Determine whether an atom is either electrically neutral or an ion by referring to its number of electrons.

S:PS1:11:2.3 Explain how the chemical properties of an element are governed by the electron configuration of atoms, and describe how atoms interact with one another by transferring or sharing the outermost electrons.

Local 2-1. Students will recognize that the enormous variety of physical and chemical properties of matter depends upon the interactions between subatomic particles.

2-8. Students will understand that chemical reaction systems are affected by the physical conditions of the system, including energy, temperature, pressure, concentration, particle size, and solubility, and by the presence of a catalyst.

Materials required polyaniline, THF, acid, beakers, tweezers, DC power source, hot plates, insulated wire, sheet copper, tin snips (or scissors), polymer sample, and conductivity testers

Lesson development Day 1 - Introduce plastic label #7 ("others polymers") What can they be like, why do we use them, and how can they be manipulated, discussing the intermolecular forces that cause these. Introduce research from UML into PANi transfer to PET. Introduce experiment for following day.
Day 2 (double block) - Experiment - Which of the six recyclable plastics accepts transfer of PANi the best? Students will design their own template from sheet copper and assemble PANi on it. Then they will use a makeshift compression press to transfer to their polymer of choice. Each group will test only one plastic and class data will be pooled. HW: Write discussion section from class data.
Day 3 - Discuss data and data analysis, relate back to day 1.

References Wei M., Tao Z., Xiong X., Kim M., Lee J., Somu S., Sengupta S., Busnaina A., Barry C., Mead J., *Macromolecular Rapid Communications*, 27(21), 1826-1832 (2006)

"Macrogalleria." Polymer Science Learning Center. Department of Polymer Science. The University of Southern Mississippi. 2005 <http://pslc.ws/macrog/index.htm>

"School Chemistry Laboratory Safety Guide." Department of Health and Human Services, Centers for Disease Control and Prevention, and National Institute for Occupational Safety and Health. 2006